Next Generation Gamma-Ray - Laue

[Draft - 07/25/11]

Name of Technology (256 char)	pixelated Ge or CZT detectors	ASICS	focusing optics
Brief description of the technology (1024)	High spectral resolution is needed to obtain nucleosynthesis signatures and spatial resolution is needed to isolate sources and maximize signal to noise. In this approach signal to noise is optimized using a focusing optical element in front of the detector array, thereby reducing the total number of detectors but requiring operation at higher count rates. Germanium and CZT have been considered as materials.	Low power ASICs are needed to provide accurate time of arrival and energy for each photon but withability to handle higher counting rates produced by focusing	Science objective is achieved in a set of narrow energy bands but with high signal to noise in those bands achieved using focusing optics
Goals and Objectives (1024)	The goal is to reach TRL 6 in 2015, to meet opportunities for near-term explorers	The goal is to reach TRL 6 by 2015	The goal is to reach TRL 6 by 2015
TRL	TRL is 4 for CZT or Ge. Requires efforts towards space qualification and testing in relevant environment.	TRL is essentially undefined until the detector is specified. The ASIC is specific to the detector and developed in co-evolution with it.	TRL is 4.
Tipping Point (100 words or less)	Designs have reached TRL 4. A focused effort could increase this to TRL 6. A few cycles of fabrication and test are realistically necessary, but must be coordinated with ASIC development.	Pixel designs require custom ASIC development to meet targets for power combined with noise level.	If a breakthrough in optics is not achieved, the preferred option will be Compton telescopes meaning larger array dimensions but without optics
NASA capabilities (100 words)	NASA's capabilities support test but strip arrays are custom procurements from commercial sources.	NASA has engineering groups producing custom ASICs at GSFC but suitable groups also exist in DoE or at commercial sources.	N ASA has no special facilities but they exist in other government departments, industry, and elsewhere, with choice of source depending on requirements and approach

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Benefit/Ranking	Ranking ii.The detector array is the primary factor determining system performance, setting the size scale, sensitivity and other factors, enabling the entire mission concept, hence the science.	Ranking ii. Detector capability alone without an ASIC suitably matched to it could lead to prohibitive system power and make the concept unworkable. Multiple turns of development are likely needed.Ranking: TBD	Ranking iii. Producing optics for this application would be largely mission specific and not transferable to other uses, but the optical solution is enabling for this approach to a medium gamma-ray mission.
NASA needs/Ranking	NASA needs a next generation medium-energy gamma-ray mission to advance understanding of nuclear astrophysics and black hole sources.	The detector alone is not sufficient and requires the ASIC. If the material is Ge, the ASIC is probably external to the refrigeration, but still needs to be low power.	Without optical system the NASA needs for a medium-energy gamma-ray mission are most likely to be achieved using Compton telescope designs.
Non-NASA but aerospace needs	none	none	none
Non aerospace needs	Detector systems mightconceivably find use in sea-level environmental monitoring but would face competition from other approaches. Ranking ii	ASICs are an integral part of the system hence contribute similarly to detectors; Ranking iv	
Technical Risk	Technical risk is low. The design principles are generally understood but progress comes through design iterations to refine performance based on completed units. Ranking ii	Technical risk is low to moderate given access to (rare) analog ASIC design expertise. The history of analogous flight projects shows this task must not be underestimated.The main challenge is to get low power with low noise. Ranking ii	Technical risk is moderate for completely new approaches.
Sequencing/Timing	Should come as early as possible. Development of other system components depends on detector unit parameters. Ranking iv	Should come as early as possible. Development of other system components depends on ASIC power performance. Ranking iv	Should come first in mission development because it is a prerequisite
Time and Effort to achieve goal	Ranking iv. Minimal effort. 3 year collaboration between industry and NASA	Ranking iv. Minimal effort. 3 year collaboration between industry and NASA	Ranking iii. Moderate effort, 3 year collaboration between industry and NASA